

OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **FRENCH POND** the program coordinators recommend the following actions. *We would like to encourage the association to conduct more sampling events in the future. With a limited amount of data it is difficult to determine water quality trends. Since weather patterns and activity in the watershed can change throughout the summer it is a good idea to sample the lake several times over the course of the season.*

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *variable* in-lake chlorophyll-a trend, with a decrease apparent since 1998. Only one sample was collected this season and its value indicated a possible algae bloom at that time. It was noted on the field data sheet that the pond appeared 'algae-murky', which would also suggest an algae bloom. Chlorophyll-a concentrations remain above the mean value for New Hampshire lakes, and are at nuisance levels. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.
- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *slightly worsening* trend in lake transparency. We assume the decreased water clarity in July was caused by high algal concentrations. The mean clarity remains below the state mean. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *fairly stable* trend for in-lake phosphorus levels. Hypolimnetic phosphorus concentrations remain extremely high, and increased again for the fifth year in a row. These elevated concentrations cause excess algae growth in the lake. Both layers have average phosphorus concentrations above the state median, with the hypolimnetic phosphorus excessively higher than the median. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- The Henniker Conservation Commission, in cooperation with the French Pond Association, applied for and received a grant from the NHDES to test phosphorus levels of the three streams that feed the pond. In the recent past there were several algae blooms that caused the pond to turn green in color. By testing the inlets biweekly we hope to determine the source of nutrients that are entering the pond. Congratulations on your proactive attempt to improve the water quality of French Pond! We look forward to working closely with the association to implement this project.
- A DES biologist did not visit the pond this summer. Therefore, we do not have a record of algal species for the summer or a current year dissolved oxygen profile. These two tests are very important, especially when the pond is showing the signs of eutrophication. It is likely that the high phosphorus concentrations were partially caused by low dissolved oxygen in the water column. The historical hypolimnetic dissolved oxygen table (Table 10) shows the pond has experienced very low concentrations of oxygen in the past. Low dissolved oxygen in the bottom of the pond can cause phosphorus to be released from the bottom sediments.
- Conductivity levels in the pond were higher this year than in previous years (Table 6), but the tributaries had reduced levels. It is likely that the rains washed any pollutants from the watershed into the tributaries, where they were flushed into the pond. We hope to uncover the reasons for the elevated conductivity levels through the monitoring project, which will begin this March.

- Cow Brook had an excessively high total phosphorus concentration in July (Table 8). This may have been a result of rains around the time of sampling. This year's average value for the brook was the highest ever recorded. French Brook and Launch Brook both had lower concentrations this year. French Brook also showed high turbidity values (Table 11), which indicate sediment may have been in the sample bottle. Please be careful when sampling the inlets to not disturb the bottom. Check the sample bottle; if sediment is apparent then dump the water out and attempt to collect a cleaner sample.

NOTES

- Monitor's Note (7/13/00): Pond is algae-murky!
- Biologist's Note (7/13/00): Internal loading of hypolimnion.

USEFUL RESOURCES

Shorelands Under the Protection of the Comprehensive Shoreland Protection Act, WD-BB-34, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

What Can You Do To Prevent Soil Erosion?, WD-BB-30, NHDES Fact Sheet. (603) 271-3503 or www.state.nh.us

A Brief History of Lakes, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

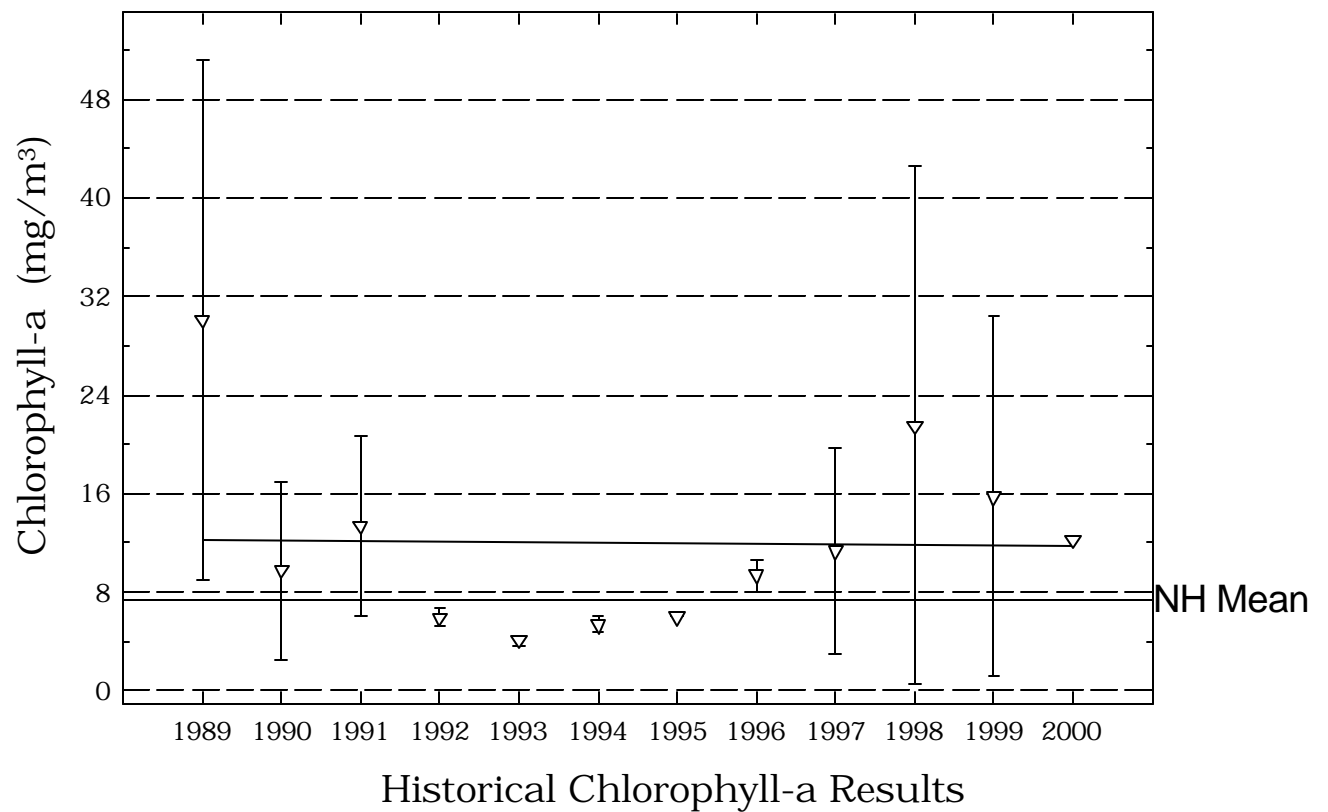
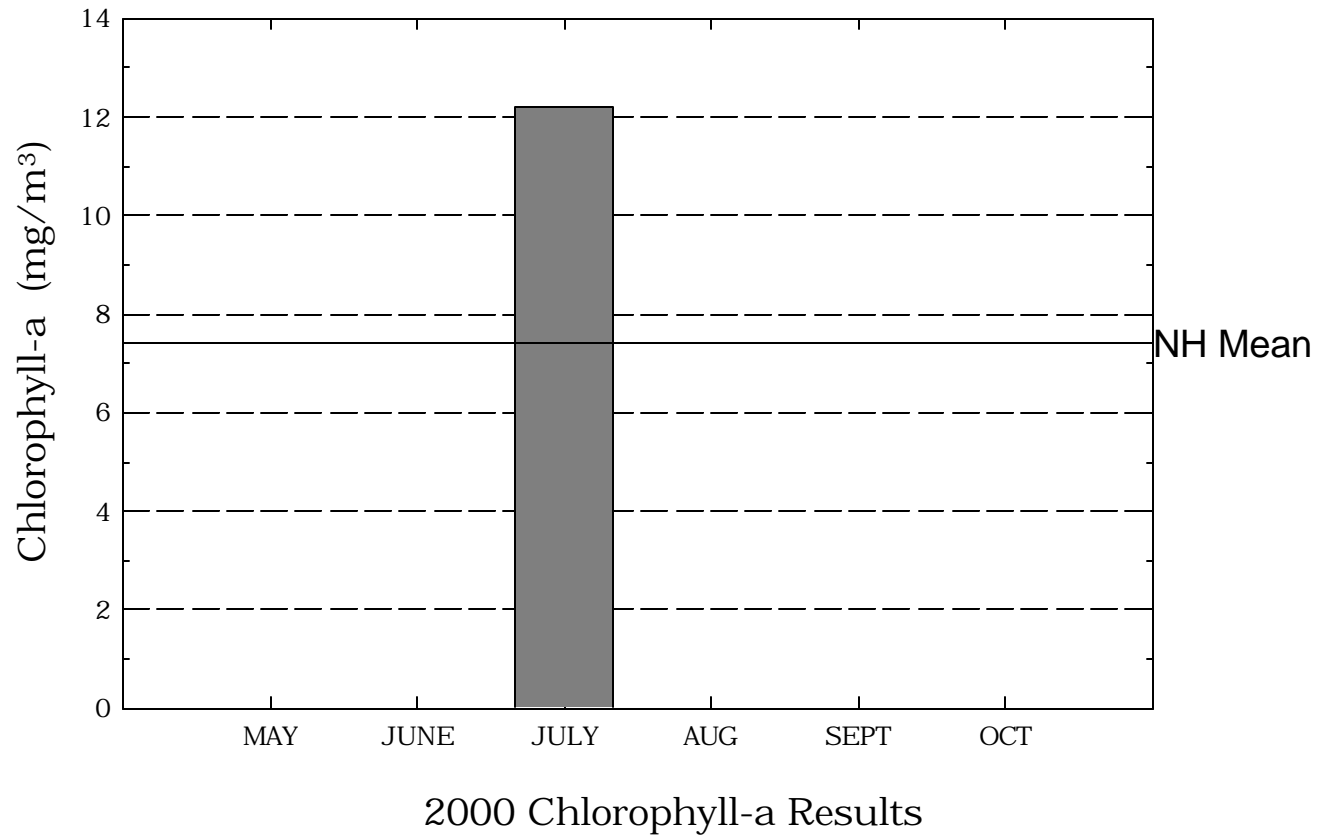
Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

What is a Watershed?, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

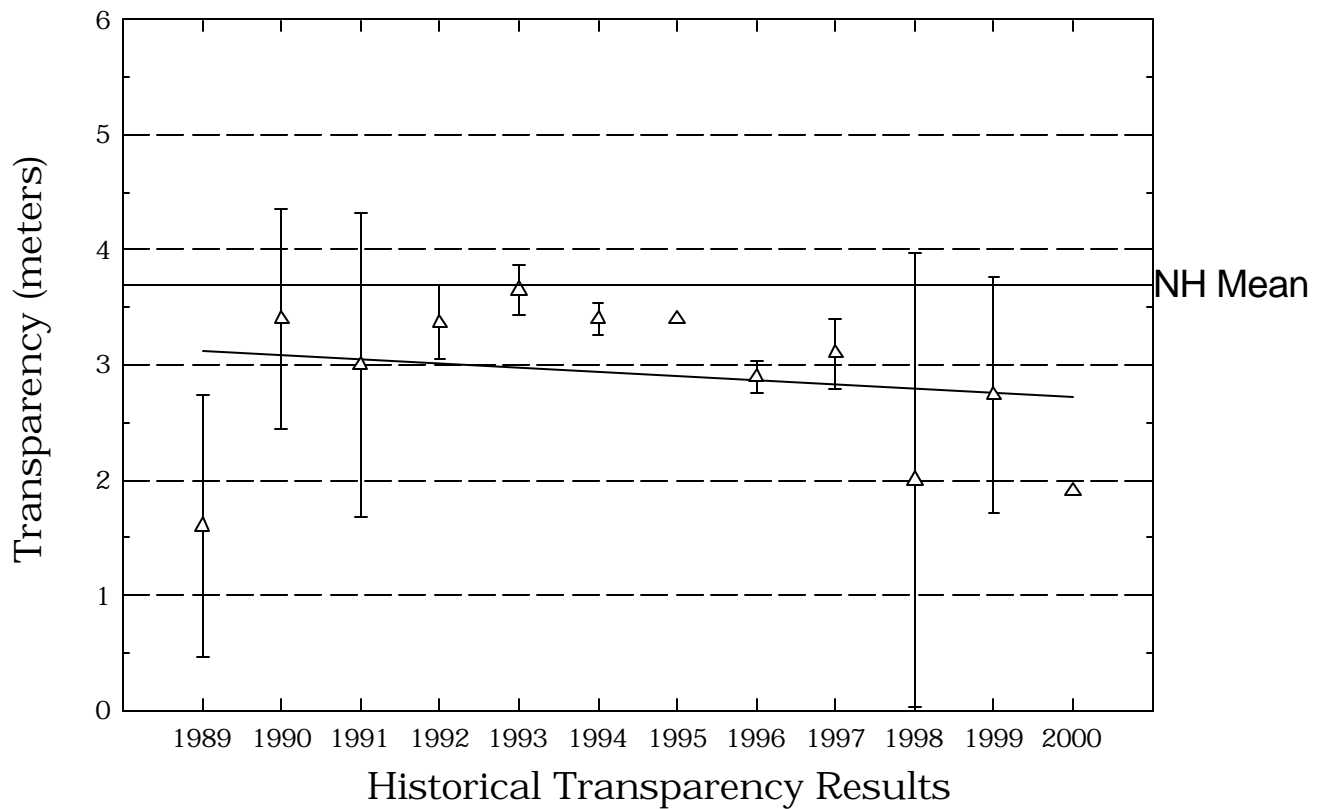
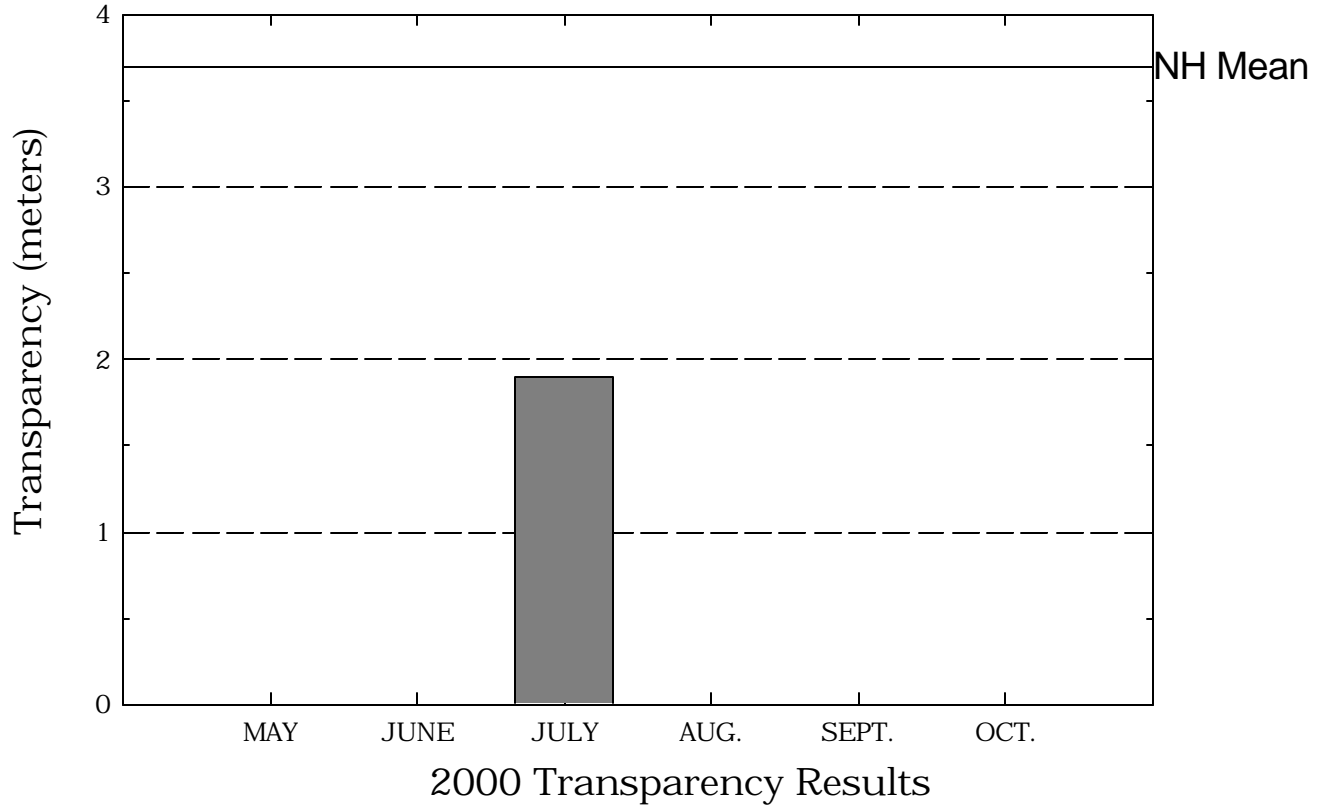
French Pond

Figure 1. Monthly and Historical Chlorophyll-a Results



French Pond

Figure 2. Monthly and Historical Transparency Results



French Pond

Figure 3. Monthly and Historical Total Phosphorus Data.

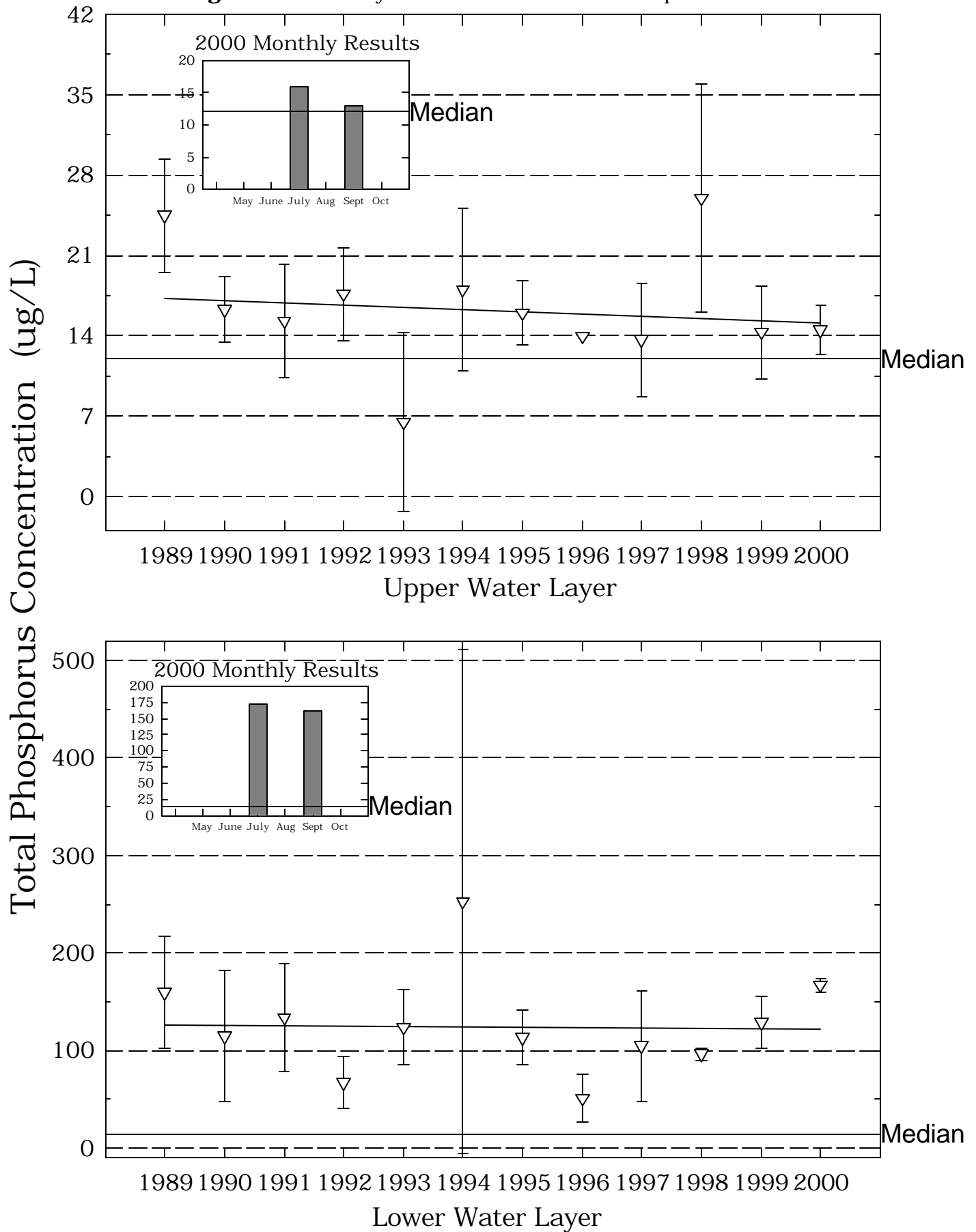


Table 1.**FRENCH POND****HENNIKER**

**Chlorophyll-a results (mg/m³) for current year and historical
sampling periods.**

Year	Minimum	Maximum	Mean
1989	15.15	45.00	30.07
1990	4.43	18.01	9.75
1991	5.81	23.10	13.38
1992	5.05	6.40	5.94
1993	3.81	4.36	4.08
1994	4.90	5.81	5.35
1995	6.00	6.02	6.01
1996	8.46	10.29	9.37
1997	3.65	20.12	11.33
1998	6.64	36.43	21.53
1999	4.93	32.36	15.75
2000	12.21	12.21	12.21

Table 2.**FRENCH POND****HENNIKER****Phytoplankton species and relative percent abundance.****Summary for current and historical sampling seasons.**

Date of Sample	Species Observed	Relative % Abundance
06/16/1989	ASTERIONELLA	60
	ANABAENA	21
06/07/1990	UROGLENOPSIS	50
	ANABAENA	24
	ASTERIONELLA	19
07/19/1991	DINOBRYON	51
	CHRYSOSPHAERELLA	16
	TABELLARIA	14
08/02/1994	CERATIUM	42
	COSMARIUM	30
	ANABAENA	23
07/24/1996	CERATIUM	34
	FRAGILARIA	12
	STAUSTRUM	8
07/15/1997	CERATIUM	55
	DINOBRYON	10
08/13/1997	CHRYSOSPHAERELLA	64
	ANABAENA	19
	CERATIUM	10
07/10/1998	ANABAENA	96
	PERIDINIUM	4
07/22/1999	CERATIUM	84
	MALLOMONAS	9
	MICROCYSTIS	3

Table 3.**FRENCH POND****HENNIKER**

**Summary of current and historical Secchi Disk
transparency results (in meters).**

Year	Minimum	Maximum	Mean
1989	0.8	2.4	1.6
1990	2.8	4.5	3.4
1991	1.5	4.0	3.0
1992	3.0	3.6	3.3
1993	3.5	3.8	3.6
1994	3.3	3.5	3.4
1995	3.4	3.4	3.4
1996	2.8	3.0	2.9
1997	2.8	3.4	3.1
1998	0.6	3.4	2.0
1999	1.6	3.6	2.7
2000	1.9	1.9	1.9

Table 4.

**FRENCH POND
HENNIKER**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
COW BROOK	1989	6.06	6.48	6.22
	1990	6.46	6.56	6.51
	1991	6.00	6.50	6.26
	1992	6.68	6.68	6.68
	1994	6.27	6.27	6.27
	1996	6.55	6.55	6.55
	1997	6.83	6.83	6.83
	1998	6.55	6.58	6.56
	1999	6.12	6.12	6.12
	2000	6.33	6.57	6.43
EPILIMNION	1989	6.95	9.73	7.25
	1990	7.11	7.29	7.21
	1991	7.26	7.50	7.34
	1992	6.87	7.13	7.02
	1993	6.98	7.05	7.01
	1994	6.97	7.15	7.05
	1995	7.20	7.40	7.29
	1996	6.86	7.02	6.93
	1997	7.07	7.27	7.19
	1998	7.25	9.49	7.55
	1999	6.87	7.50	7.18
	2000	6.88	7.18	7.00

Table 4.**FRENCH POND
HENNIKER**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
FRENCH BROOK	1991	7.10	7.60	7.29
	1992	7.46	7.46	7.46
	1994	7.17	7.17	7.17
	1996	7.06	7.06	7.06
	1998	7.15	7.22	7.18
	1999	7.32	7.32	7.32
	2000	5.86	7.00	6.13
HYPOLIMNION	1989	6.48	6.50	6.49
	1990	6.27	6.45	6.38
	1991	6.24	6.60	6.42
	1992	6.33	6.45	6.38
	1993	6.34	6.42	6.38
	1994	6.31	7.07	6.54
	1995	6.30	6.57	6.41
	1996	6.24	6.28	6.26
	1997	6.24	6.52	6.33
	1998	6.21	6.36	6.28
	1999	6.25	6.52	6.38
	2000	6.34	6.42	6.38
LAUNCH BROOK 1	1994	6.73	6.73	6.73

Table 4.**FRENCH POND
HENNIKER**

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
LAUNCH BROOK	1989	6.49	6.92	6.65
	1990	6.88	7.07	6.98
	1991	6.50	7.40	6.82
	1992	6.90	7.03	6.96
	1994	7.02	7.02	7.02
	1996	6.86	7.04	6.94
	1998	6.90	6.90	6.90
	1999	6.92	7.07	6.99
	2000	5.66	6.88	5.94
METALIMNION	1989	6.35	6.72	6.50
	1990	6.79	7.08	6.91
	1991	6.68	7.21	6.93
	1992	6.89	8.14	7.15
	1993	6.69	6.89	6.78
	1994	6.91	7.16	7.02
	1995	6.58	7.13	6.77
	1996	6.54	6.60	6.57
	1997	6.35	7.29	6.66
	1998	6.39	7.13	6.62
	1999	6.46	6.81	6.56
	2000	6.50	6.51	6.51
OUTLET	1989	6.96	8.43	7.25
	1990	7.10	7.24	7.16

Table 4.

**FRENCH POND
HENNIKER**

**pH summary for current and historical sampling seasons.
Values in units, listed by station and year.**

Station	Year	Minimum	Maximum	Mean
OUTLET	1991	6.30	7.10	6.62
	1992	6.96	7.61	7.14
	1994	7.02	7.35	7.13
	1995	7.38	7.38	7.38
	1996	7.05	7.23	7.13
	1997	6.93	6.93	6.93
	1998	7.30	7.42	7.36
	1999	6.58	6.96	6.75
	2000	7.04	7.04	7.04
UPPER LAYER				
	2000	5.84	6.44	6.04

Table 5.**FRENCH POND****HENNIKER****Summary of current and historical Acid Neutralizing Capacity.****Values expressed in mg/L as CaCO₃.****Epilimnetic Values**

Year	Minimum	Maximum	Mean
1989	4.30	10.10	7.93
1990	7.70	9.00	8.33
1991	7.80	8.30	8.03
1992	6.50	9.10	7.87
1993	8.50	8.60	8.55
1994	6.60	9.40	8.00
1995	8.10	8.70	8.40
1996	6.60	8.40	7.50
1997	7.60	8.00	7.83
1998	7.00	7.60	7.30
1999	7.40	9.60	8.57
2000	8.00	9.90	8.95

Table 6.

**FRENCH POND
HENNIKER**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
COW BROOK	1989	48.0	64.8	56.4
	1990	58.6	61.7	60.1
	1991	60.4	71.4	65.7
	1992	65.0	74.3	69.6
	1994	86.7	86.7	86.7
	1996	90.7	90.7	90.7
	1997	98.8	98.8	98.8
	1998	108.5	109.6	109.0
	1999	190.7	190.7	190.7
	2000	143.4	206.0	174.7
EPILIMNION	1989	61.2	68.5	64.8
	1990	63.6	64.9	64.0
	1991	61.9	62.8	62.4
	1992	65.2	66.4	65.9
	1993	72.9	73.0	72.9
	1994	75.8	77.4	76.6
	1995	78.5	79.6	79.0
	1996	75.4	76.1	75.7
	1997	74.9	79.2	76.3
	1998	79.9	80.3	80.1
	1999	92.4	94.1	93.1
	2000	92.9	95.3	94.1

Table 6.

**FRENCH POND
HENNIKER**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
FRENCH BROOK	1991	169.4	271.3	235.9
	1992	217.8	217.8	217.8
	1994	228.5	228.5	228.5
	1996	253.0	253.0	253.0
	1998	255.7	292.0	273.8
	1999	355.0	355.0	355.0
	2000	193.0	258.0	225.5
HYPOLIMNION	1989	75.8	82.5	79.1
	1990	69.7	83.9	76.8
	1991	70.1	80.8	74.7
	1992	68.0	77.1	71.8
	1993	78.8	82.4	80.6
	1994	76.1	94.0	85.0
	1995	82.1	88.0	85.0
	1996	84.2	84.9	84.5
	1997	80.7	90.1	86.1
	1998	90.5	91.7	91.1
	1999	110.6	116.6	112.7
	2000	112.0	117.7	114.8
LAUNCH BROOK 1	1994	76.6	76.6	76.6
LAUNCH BROOK	1989	46.1	109.3	77.7
	1990	73.9	96.5	84.9

Table 6.

FRENCH POND

HENNIKER

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1991	62.9	103.3	85.6
	1992	55.2	64.9	60.0
	1994	106.0	106.0	106.0
	1996	71.2	84.1	77.6
	1998	87.3	87.3	87.3
	1999	126.0	175.3	150.6
	2000	50.6	129.8	90.2
METALIMNION				
	1989	63.1	65.5	64.3
	1990	63.9	64.3	64.1
	1991	59.9	62.4	61.1
	1992	64.4	65.5	64.9
	1993	71.2	72.3	71.7
	1994	75.2	75.5	75.3
	1995	77.0	79.1	78.0
	1996	76.7	76.8	76.7
	1997	72.7	75.9	74.0
	1998	78.0	80.8	79.4
	1999	88.6	95.6	92.9
	2000	93.4	94.1	93.7
OUTLET				
	1989	60.7	62.3	61.5
	1990	61.5	65.2	63.9
	1991	60.0	62.4	61.3
	1992	65.3	67.1	66.5
	1994	73.0	210.0	119.9

Table 6.**FRENCH POND****HENNIKER**

**Specific conductance results from current and historic
sampling seasons. Results in uMhos/cm.**

Station	Year	Minimum	Maximum	Mean
	1995	76.9	76.9	76.9
	1996	74.9	76.6	75.7
	1997	74.8	74.8	74.8
	1998	75.4	80.3	77.8
	1999	90.9	101.0	95.2
	2000	92.5	92.5	92.5
UPPER LAYER				
	2000	69.1	107.2	88.1

Table 8.

FRENCH POND

HENNIKER

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
COW BROOK	1989	20	20	20
	1990	14	16	15
	1991	15	36	22
	1992	19	19	19
	1996	21	21	21
	1997	43	43	43
	1998	48	49	48
	1999	34	34	34
	2000	53	116	84
EPILIMNION	1989	21	28	24
	1990	13	18	16
	1991	12	21	15
	1992	14	22	17
	1993	1	12	6
	1994	13	23	18
	1995	14	18	16
	1996	14	14	14
	1997	8	17	13
	1998	19	33	26
	1999	10	18	14
	2000	13	16	14
FRENCH BROOK	1991	118	193	148
	1992	72	72	72

Table 8.**FRENCH POND****HENNIKER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1993	15	15	15
	1994	83	83	83
	1996	65	65	65
	1998	54	69	61
	1999	346	346	346
	2000	32	50	41
HYPOLIMNION	1989	119	200	159
	1990	55	187	115
	1991	82	208	133
	1992	47	98	67
	1993	97	151	124
	1994	70	435	252
	1995	94	133	113
	1996	34	68	51
	1997	46	159	105
	1998	92	101	96
	1999	109	159	129
	2000	162	172	167
LAUNCH BROOK 1	1994	33	33	33
LAUNCH BROOK 2	1994	34	34	34
LAUNCH BROOK	1989	43	63	53
	1990	34	118	63

Table 8.**FRENCH POND****HENNIKER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1991	38	70	57
	1992	38	47	42
	1994	42	42	42
	1996	45	81	63
	1998	32	32	32
	1999	46	146	96
	2000	51	60	55
METALIMNION	1989	26	28	27
	1990	15	24	18
	1991	17	27	23
	1992	14	25	18
	1993	13	16	14
	1994	14	21	17
	1995	13	22	17
	1996	20	26	23
	1997	13	30	21
	1998	13	14	13
	1999	15	22	18
	2000	20	21	20
OUTLET	1989	23	31	27
	1990	14	19	16
	1991	14	19	17
	1992	12	16	13
	1994	6	74	33

Table 8.

**FRENCH POND
HENNIKER**

**Summary historical and current sampling season Total
Phosphorus data. Results in ug/L.**

Station	Year	Minimum	Maximum	Mean
	1995	13	13	13
	1996	12	20	16
	1997	13	13	13
	1998	11	22	16
	1999	7	27	17
	2000	10	10	10
UPPER LAYER				
	2000	13	62	37

Table 10.**FRENCH POND
HENNIKER****Historic Hypolimnetic dissolved oxygen and temperature data.**

Date	Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
June 16, 1989	11.5	5.7	0.6	5.0
June 7, 1990	11.0	5.6	0.0	0.0
July 19, 1991	9.0	8.0	0.2	1.7
August 2, 1994	8.0	6.0	0.1	1.0
July 24, 1996	11.0	6.3	0.3	2.0
July 15, 1997	11.5	5.0	0.1	1.0
August 13, 1997	11.5	5.6	0.1	1.0
July 10, 1998	11.0	5.5	0.1	0.0
July 22, 1999	11.5	6.3	0.8	6.6

Table 11.

**FRENCH POND
HENNIKER**

**Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
COW BROOK	1997	0.4	0.4	0.4
	1998	0.4	1.7	1.0
	1999	0.3	0.3	0.3
	2000	1.3	1.5	1.4
EPILIMNION	1997	0.6	0.8	0.7
	1998	1.2	13.6	7.4
	1999	1.0	2.2	1.6
	2000	1.4	2.6	2.0
FRENCH BROOK	1998	0.9	1.4	1.1
	1999	2.5	2.5	2.5
	2000	0.6	26.0	13.3
HYPOLIMNION	1997	1.9	7.8	5.6
	1998	6.2	7.5	6.8
	1999	7.9	14.6	10.4
	2000	3.1	9.9	6.5
LAUNCH BROOK	1998	1.3	1.3	1.3
	1999	2.7	7.0	4.8
	2000	0.4	1.9	1.1
METALIMNION	1997	0.8	1.2	1.0
	1998	1.0	1.5	1.2

Table 11.

**FRENCH POND
HENNIKER**

**Summary of current year and historic turbidity sampling.
Results in NTU's.**

Station	Year	Minimum	Maximum	Mean
OUTLET	1999	1.0	1.3	1.1
	2000	1.9	2.1	2.0
	1997	0.7	0.7	0.7
	1998	1.6	11.8	6.7
UPPER LAYER	1999	0.9	3.5	2.0
	2000	1.7	1.7	1.7
	2000	0.3	5.5	2.9